

Inability of Young *Chilocorus* Larvae to Attack the Mature Stage of the Latania Scale

(Coleoptera: Coccinellidae)

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While conducting a series of studies of the biologies of several species of the coccinellid genus *Chilocorus* Leach, it was noted that the young larvae of the predator were considerably smaller than the mature stage of the host scale, *Hemiberlesia lataniae* (Signoret). Tests were set up to determine if the scale was invulnerable at any time during its life cycle to the attack of the coccinellids.

Methods and Materials

The coccinellid, *Chilocorus orbus* Casey was reared on *H. lataniae* cultured on potato tubers. The insectary procedure for the production of the host scale was a modification of the method described by Flanders (1951) for the culture of *Aonidiella auranti* (Maskell). For the tests, individual tubers infested with *H. lataniae* were selected and all the scales not in the required stage were removed from a portion of the potato. A circular cut was made around this area with a cork borer. One end of a section of glass tubing (ca 2.0 x 5.0 cm) was inserted into this cut thereby enclosing the area containing scales of a uniform stage. The other end of the glass tube was closed with a piece of organdy cloth held in place by a cork stopper. The center of the stopper was removed to allow adequate ventilation. Because the scale has a long life cycle (Ebeling 1950), it remained in each instar long enough to complete the tests. All tests were maintained in an insectary at $T = 28^{\circ} \pm 0.5^{\circ}\text{C}$, RH 28-42%, and continuous light.

Four distinct sedentary forms of the scale were tested. The early first-instar, the first form, is very small and has a white or pale yellow covering. The second form tested was the late first-instar scale, which is larger in size and is dark yellow. The third form tested was the second-instar scale. In the latter most of the scale covering is a very dark brown or black. The final form tested was the adult female scale. It is much larger than the second-instar, being from 1.5 to 2.00 mm in diameter and has the exuviae of the first and second instars subcentral in position and surrounded by a grayish-white area. The scale covering is strongly convex.

Results

The results of this experiment are presented in Table 1. All first instar beetle larvae tested on early first-instar scales were able to develop to the

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second-instar. Also, 8 of the 9 first-instar coccinellid larvae tested on late first-instar scales developed to the second-instar. All the first-instars successfully attacked the second-instars of the scale. However, only 2, or 9.0% of the 22 beetle larvae tested survived the second-instar when placed on mature scales. Because several crawlers were found in the units with the 2 surviving predator larvae, it is believed that crawlers served as host material, thereby accounting for the survival of the 2 larvae. When second-instar *Chilocorus* were placed on the scales that already had resisted the attack of the younger coccinellid larvae, 83% of these coccinellids survived. Therefore, any further tests of other larval instars were deemed unnecessary.

From these results it was assumed that the first-instar larvae of *C. orbus* were unable to attack successfully the adults of *H. lataniae* (Signoret), while all other stages of the scale were successfully fed upon by the first-instar predators. The covering of the adult scale did not protect it from the second-instar larvae, and therefore, must be more susceptible to attack by later instars of *Chilocorus*. Clausen (1940) stated that successful utilization of coccinellids against diaspine scales appears to be limited by certain physical characters of the scale covering. Those species of scale possessing a relatively thin, readily penetrated covering have been the subjects of partial or complete control by coccinellids. Conversely, those species with exceptionally thick or tough covering such as *Lepidosaphes* Shimer are relatively free from coccinellid attack.

In these experiments, the mature scale was free from attack because the *Chilocorus* larvae were evidently unable to penetrate the scale covering. On several occasions the first-instar larvae were observed trying to bite through the covering but they were unable to puncture the surface of the scale with their mandibles. The first-instar larvae were able to cope with the covering of younger scales, and the second-instar larvae were capable of feeding on all stages of the scale.

Table 1. — Results of feeding tests involving first and second instar larvae of *Chilocrus orbus* on different instars of the scale *Hemiberlesia lataniae*.

Predator tested	Host instar tested	No. larvae involved	No. larvae developing	Percent surviving
first	early 1st	4	4	100
first	late 1st	9	8	89
first	second	6	6	100
first	third	22	2	9
second	third	6	5	82

Latania scale seems to be a species of diaspine scale somewhat intermediate between those susceptible to attack by all instars of *C. orbus* and scales relatively free from attack. Muma (1955) reported that all stages of the scale, *Chrysomphalus aonidum* (L.), were fed on by all larval instars of *C. stigma* Say. However, Clausen (1940) stated that species of the genera *Lepidosaphes* and *Chionaspis* are relatively free from attack. In addition, Reyne (1948) reports that *C. nigritus* F. was not able to penetrate the cuticle of *Aspidiotus rigidus* Reyne, whereas it was able to attack successfully *A. destructor* Signoret.

This ability of some species of scales to withstand, during some stage in their cycle, the onslaught of a particular larval instar of a coccinellid may partially explain conflicting reports as to the efficiency of the beetles for natural control of these coccid species. For example, in Florida, *Chrysomphalus aonidum* (L.) on citrus is held in check by *C. stigma* (Griffith and Stearns 1947), while in Algeria, poor control of the same species of scale is effected by *C. bipustulatus* (L.) (Balachowsky, 1928).

Whenever possible, attempts at colonization of an insect should be synchronized with the susceptible stages of the host species. The failure of some species of Chilocorini to control various scale insects or even become established in a new area, may be due in part to the lack of such synchronization between the predator and a susceptible stage of the host.

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